DOCUMENT RESUME

ED 309 931 SE 050 761

AUTHOR Shanebrook, J. Richard
TITLE Nuclear Technology in War and Peace: A Study of Issues and Choices.
PUB DATE Jul 89
NOTE 8p.
PUB TYPE Guides - Classroom Use - Guides (For Teachers) (052)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *College Science; *Course Descriptions; Higher Education; *Nuclear Energy; Nuclear Physics; Nuclear Power Plants; *Nuclear Technology; Nuclear Warfare; *Science and Society; Science Curriculum

ABSTRACT

This is the syllabus of a course that explores the technology of nuclear weapons and nuclear energy for electric power generation, and considers some problems of nuclear weapons proliferation and technical alternatives. It provides a course description, a course outline, a list of required readings, and information on the films shown in the course. Topics included in the course are: (1) "Origin of Energy, Matter, and Life in Our Universe"; (2) "The Atomic Structure of Matter"; (3) "Nuclear Fission"; (4) "The Atomic Bomb"; (5) "The Hydrogen Bomb"; (6) "Nuclear Energy for Electric Power Production"; (7) "The Breeder Reactor"; (8) "Energy Choices"; (9) "Nuclear Weapon Systems Today"; and (10) "Survival in a Nuclear Age." (YP)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED309931

NUCLEAR TECHNOLOGY IN WAR AND PEACE:
A STUDY OF ISSUES AND CHOICES

by

J. Richard Shanebrook, Ph.D.

Union College

Schenectady, New York

July, 1989

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☒ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

Richard Shanebrook

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

SE 050 761

BEST COPY AVAILABLE

1. Course Title and Catalog Description for Engineering Liberal Learning 49

ELL 49. "Nuclear Technology in War and Peace: A Study of Issues and Choices". Explores the technology of nuclear weapons and nuclear energy for electric power generation. Associated problems of nuclear weapons proliferation and technological alternatives are considered.

2. Responsible Professor

J. Richard Shanebrook
Mechanical Engineering Department

3. Prerequisites

This course has no prerequisites and is open to students of any major or year of standing.

4. Course Description

The course begins with an historical account of the scientific discoveries leading up to the uranium experiments of Hahn and Strassman in Germany and the subsequent explanation of nuclear fission by Meitner and Frisch. Following this, the technological achievements of the Manhattan Project are presented including techniques of uranium enrichment, extraction of plutonium from irradiated reactor fuel rods, and the design of "gun barrel" and implosion types of nuclear weapons. This discussion concludes with a viewing of the award-winning film, "The Day After Trinity: J. Robert Oppenheimer and the Atomic Bomb."

Covered next are the atomic bombings of Hiroshima and Nagasaki with a class assignment to read John Hersey's book, Hiroshima. Included in this topic is a viewing of the film, "Hiroshima and Nagasaki: The Harvest of Nuclear War." This film was produced in

Japan (March 1982) and was planned by the cities of Hiroshima and Nagasaki. It features film footage recorded by Japanese photographers shortly after the nuclear explosions at these two cities in August of 1945. Interviews with survivors of the bombings are also presented in order to accurately describe the horrible consequences of using nuclear weapons against human beings. From a pedagogical standpoint, the reading of Hiroshima and the viewing of this film proved to be very beneficial to the course as a whole since they both portrayed actual events and consequences of nuclear warfare.

The course then covers the "Atoms for Peace" program that was initiated by President Eisenhower in 1953. Particular emphasis is placed on the technology of nuclear power plants such as pressurized water reactors and the liquid metal fast breeder reactor. This includes the reading of one pro-nuclear power book by Fred and Geoffrey Hoyle, Commonsense in Nuclear Energy, and one anti-nuclear power book by Anna Gyorgy, No Nukes. The discussion on breeder reactors includes arguments for and against this technology which leads naturally to a discussion of nuclear weapons proliferation. The latter topic is enhanced by a reading of John McPhee's, The Curve of Binding Energy.

The final portion of the course is concerned with the technology of modern nuclear weapons and delivery systems. The weapons discussion includes thermonuclear devices (fission-fusion-fission) as well as radiological weapons such as the cobalt bomb. The discussion of waging modern nuclear war is based on the book, The Counterforce

Syndrome, by Robert C. Aldridge and includes the following technological systems:

Anti-satellite weapons

Counterforce missiles

Anti-submarine weapons

Anti-ballistic missile weapons

Command, control, and communication networks

The above discussion is a brief outline of the major topics of this course. Several other topics are interwoven throughout the course such as "peace through strength" arguments in favor of increased armaments, civil defense measures, and technological alternatives to nuclear power.

5. Course Outline for ELL 49

I. Origin of Energy, Matter, and Life in Our Universe
   A. The Big Bang Theory
   B. Hydrogen and uranium formation (supernovae explosions)
   C. Life on earth
   D. Deoxyribonucleic acid

II. The Atomic Structure of Matter
   A. Natural and man-made elements
   B. Radioactivity
   C. Discoveries of Roentgen, Becquerel and Curie
   D. Rutherford's Theory
   E. Isotopes
   F. The neutron (James Chadwick)
   G. The equivalence of mass and energy (Albert Einstein)

III. Nuclear Fission
   A. The experiments of Hahn and Strassman in Germany, as explained by Meitner and Frisch
   B. Fissionable materials (isotopes)
   C. The discovery of plutonium

IV. The Atomic Bomb
   A. Szilard, Wigner, and Einstein foresee military applications of nuclear fission
   B. The Manhattan Project: Profiles of Robert Oppenheimer and Edward Teller
   C. The decision to drop the bomb on Japan
      1. The Franck Report of June 11, 1945
      2. The Chicago poll of scientists (June, 1945)

D. The Trinity Test of a plutonium weapon
E. Hiroshima
F. Nagasaki

V. The Hydrogen Bomb
A. Edward Teller and the "Super Bomb"
B. Claus Fuchs, the Russian Agent
C. Opposition to building the hydrogen bomb
D. The decision to build the first thermonuclear weapon

VI. Nuclear Energy for Electric Power Production
A. The Atomic Energy Act of 1946
B. Arguments in favor of nuclear power plants
C. Arguments opposed to nuclear power plants
D. Current status of power reactors in America and the world

VII. The Breeder Reactor
A. Supplies of Uranium-235
B. Elements of a plutonium society
C. Arguments in favor of breeder reactors
D. Arguments opposed to breeder reactors
E. Current status of breeder reactors in America and the world

VIII. Energy Choices
A. The end of the fossil fuel era on earth
B. The need for energy in a technological society
C. The effect of population growth on energy demand
D. Nuclear energy vs. solar energy: Which path to take?
E. Energy for Third World nations
F. The relationship between energy needs and armed conflict (The Carter Doctrine)

IX. Nuclear Weapon Systems Today
A. Nuclear arsenals in America and Russia
B. Delivery systems from land, sea, and air
C. Counterforce weapons (MX, Trident, Cruise Missiles)
D. Command, control, and communication systems for a first-strike nuclear attack

X. Survival in a Nuclear Age
A. Treaties to prevent the spread of nuclear weapons (Antarctic, Outer Space, Latin America, Non-Proliferation, Seabed)
B. Treaties to reduce the risk of nuclear war between the United States and Russia (Hot-line agreement, accidents measures, prevention of nuclear war)
C. The partial test ban treaty
D. Salt I
E. Civil Defense
F. Survival skills (C.H. Kearny)

6. List of Required Readings

A. Hiroshima by John Hersey, Bantam Books, 1985.

B. Commonsense in Nuclear Energy by Fred Hoyle and Geoffrey Hoyle, W.H. Freeman and Co., 1980.

C. No Nukes by Anna Gyorgy, South End Press, 1980.

D. The Curve of Binding Energy by John McPhee, Ballantine Books, 1974.

E. Energy One by J.Richard Shanebrook, Union College, 1988.

F. "To Breed or Not to Breed?" by Alvin M. Weinberg, Across the Board, The Conference Board Magazine, Vol. 14, September 1977, pp. 5-24.

G. The Counterforce Syndrome: A Guide to U.S. Nuclear Weapons and Strategic Doctrine by Robert C. Aldridge, Institute for Policy Studies, 1978.

H. Nuclear War Survival Skills by Cresson H. Kearny, National Technical Information Service, U.S. Department of Commerce, Springfield, Virginia, 1979.

7. Information on the Films Shown in this Course

A. "The Day After Trinity: J. Robert Oppenheimer and the Atomic Bomb". Available from Michigan Media, 416 Fourth St., Ann Arbor, MI 48109.

B. "Hiroshima and Nagasaki: The Harvest of Nuclear War". Available from Wilmington College Peace Resource Center, Pyle Center, Box 1183, Wilmington, OH 45177.

C. "Countdown for America". This film probes the campaign for a nuclear weapons freeze as contrasted with the campaign for a national strategy of peace through strength. Available from the American Security Council Foundation, Boston, Virginia 22713.